Find the vertex and x-intercepts of the function

Vertex ← $f(x)=x^2+2x-15$ → x-int $(x+5)(x-3)$

$x^2+2x+\underline{1}-\underline{1}-15$

$(x+1)^2-16$

v: $(-1,-16)$

aos: $x=-1$

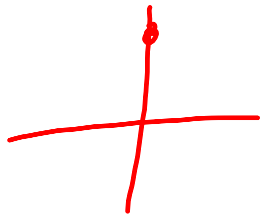
-15

$5 \quad -3$

$1 \quad 2 \quad 1$

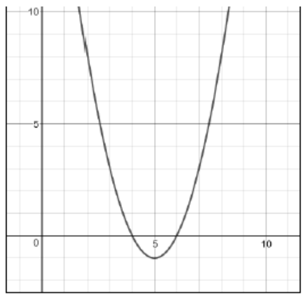
x-int: $(-5,0)(3,0)$

y-int $(0,-15)$



Homework 4.4 Solutions

1. Vertex Form: $f(x)=(x-5)^2-1$
   Intercept Form: $f(x)=(x-4)(x-6)$
   x-intercepts: (4, 0), (6, 0) y-intercept: (0, 24) vertex: (5, –1) axis of symmetry: $x=5$



2. Polynomial Form: $f(x)=-x^2+6x+16$
   Intercept Form: $f(x)=-(x+2)(x-8)$
   x-intercepts: (–2, 0), (8, 0) y-intercept: (0, 16) vertex: (3, 25) axis of symmetry: $x=3$

3. Polynomial Form: $f(x)=x^2-10x-56$
   Vertex Form: $f(x)=(x-5)^2-81$
   x-intercepts: (–4, 0), (14, 0) y-intercept: (0, –56) vertex: (5, –81) axis of symmetry: $x=5$

4. Vertex Form: $f(x)=2(x+3)^2-2$
   Intercept Form: $f(x)=2(x+2)(x+4)$
   x-intercepts: (–4, 0), (–2, 0) y-intercept: (0, 16) vertex: (–3, –2) axis of symmetry: $x=-3$

5. $f(x)=x^2-4x+7$ or $f(x)=(x-2)^2+3$
6. $f(x)=2x^2-12x+16$ or $f(x)=2(x-2)(x-4)$ or $f(x)=2(x-3)^2-2$
7. $f(x)=x^2-4x-12$ or $f(x)=(x+2)(x-6)$ or $f(x)=(x-2)^2-16$
8. $f(x)=\frac{1}{4}x^2+2x$ or $f(x)=\frac{1}{4}(x)(x+8)$ or $f(x)=\frac{1}{4}(x+4)^2-4$

★ 9. $f(x)=(x+3+\sqrt{5})(x+3-\sqrt{5})$

2) $-(x-3)^2+25$ v: $(3,25)$ aos: $x=3$

$-(x-3)(x-3)+25$

$-(x^2-3x-3x+9)+25$

$-(x^2-6x+9)+25$

$-x^2+6x-9+25$

$f(x)=-x^2+6x+16$

$-(x^2-6x-16)$

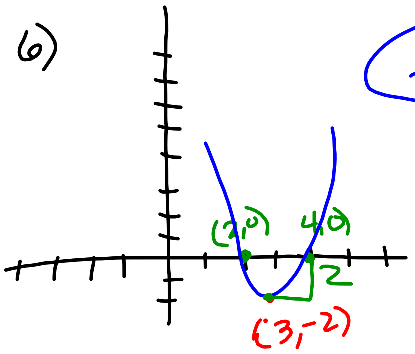
$f(x)=-(x-8)(x+2)$

y: $(0,16)$

x: $(8,0)$ $(-2,0)$

-16
$\frac{-8}{1}$ $\frac{2}{1}$
-6

6)



$\boxed{f(x)=2(x-3)^2-2}$

$2(x-2)(x-4)$

Lesson 4.5 objectives

I can solve real-world problems with properties of quadratics

There are many ways quadratics can be used to solve real-world problems – so many that it would be impractical to discuss all of them. However, here are a few tips that can guide you as you solve these types of problems.

- **Using or Finding the Vertex**
  The problem has to do with the minimum or maximum. Look for phrases like: "*find the minimum cost*", or "*what is the maximum height*".
- **Using or Finding x-Intercepts**
  The problem will be looking for when the model equals zero. Typical phrases are: "*when it hits the ground*", or "*when does the company earn zero profit*".
- **Make an Equation to Solve**
  If you can possibly find an equation in the problem by substituting given values or expressions, then do it. Then solve for the unknown.

vertex: $(-b/2a$

$a \quad b \quad c=0$

1. A cannon fires a cannonball at a castle. The height of the cannonball can be modeled by $h(t) = -16t^2 + 224t$, where $h(t)$ is the height in feet of the cannonball t seconds after it is fired.

$(7, 784) \leftarrow$ a.

$\frac{-224}{2(-16)} = \frac{-224}{-32}$

$-16(7)^2 + 224(7)$

   A. What is the maximum height of the cannonball?
   B. At what time does it achieve that height? 7 sec.
   C. How many seconds pass from the time it's fired until the cannonball hits the castle? (Assume the heights of the castle and the cannon are the same.) $-16t(t-14)$ $(0,0)$ $(14,0)$ 14 sec
   D. At what two times is the height of the cannonball equal to 720 ft.?

$720 = -16t^2 + 224t$

$+16t^2 \quad +\cancel{16t^2} - 224t$

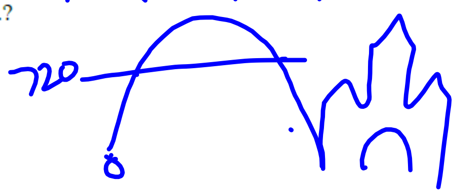
$-224t$

$16t^2 - 224t + 720 = 0$

$16(t^2 - 14t + 45) = 0$

$16(t-9)(t-5) = 0$

$t = 9, 5$



2. From a stopped position, a car starts to accelerate at a constant rate. The following table shows the total distance the car traveled at each second.

time (sec.)	dist. (ft.)
0	0
1	3
2	12
3	27
4	48
5	75

A. Make a model for distance in terms of time. $d(t) =$ $3t^2$

B. At what time will the car have traveled 300 feet?

$\frac{300}{3} = \frac{3t^2}{3}$ $\sqrt{100} = \sqrt{t^2}$ 10 secs

$t = \pm 10$

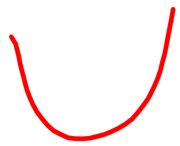
3. A company has determined its cost for producing a certain item is modeled by $C(x) = 0.1x^2 - 20x + 1350$, where $C(x)$ is the cost per item in dollars when x items are produced at one time.

A. What is the cost per item when 50 items are produced at one time? 600

B. How many items should be produced in order to minimize cost? 100

C. What is the minimum cost per item?

$ 350



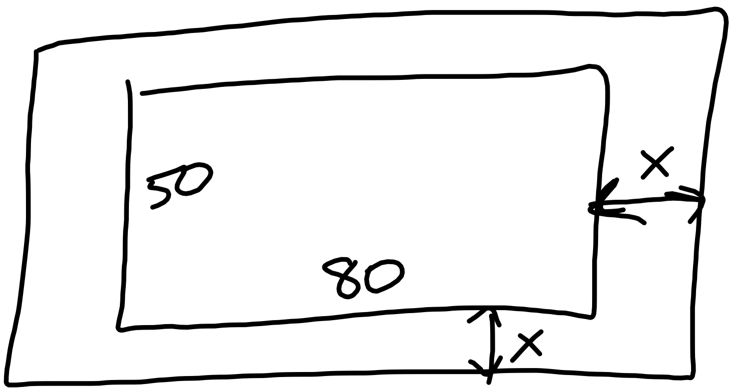
$\left(\frac{-b}{2a}, \text{plug in}\right)$

$\frac{20}{2(.1)} = \frac{20}{.2}$

$(100, 350)$

x	y
2	-3
3	-6
4	-7
5	-6
6	-3

$$f(x)=(x-4)^2-7$$



$$(80+2x)(50+2x)$$